

## REMARKS

Claims 1-5, 7-11 and 14-24 are in this application and are presented for consideration. By this amendment, Applicant has amended claims 1, 10, 11, 15 and 20. Applicant has also canceled claims 6, 12 and 13. New claims 21-24 have been added.

Claims 1-14 have been rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

Applicant has amended claims 1 and 10 paying close attention to the Examiner's remarks. It is Applicant's position that the claims as now presented are clear and fully comply with the requirements of the statute. Accordingly, Applicant respectfully requests that the Examiner remove the rejection in light of the changes made to the claims.

Claims 1, 3, 5-11, 15 and 19 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Bannister (U.S. 4,626,999) in view of Mangiarino et al. (U.S. 2002/0104834) and Faitel (U.S. 2002/0170889).

The present invention relates to a process for the laser beam machining of components. The process includes guiding a laser head with a manipulator with a multiaxial manipulator hand. The remote laser head is arranged externally on the manipulator hand. The laser head emits a laser beam. The emitted laser beam is guided along a welding or cutting path on the component by orientation modifications and with a variable irradiation angle  $\beta$ . The changes in the orientation of the laser beam are generated only by pivoting motions of the manipulator hand about at least one of the hand axes. At least one of a laser output and a velocity of the

welding or cutting is adjusted as a function of the irradiation angles  $\beta$  of the laser beam. The present invention allows for a simple motion control that has significant engineering and economic advantages since the existing axes of the manipulator and auxiliary axes at or in the laser head are dispensable, which greatly simplifies the robot control. This advantageously allows an existing manipulator to be used as it is and a special adaptation of the device is not necessary. This advantageously provides for rapid and precise movement of the laser beam due to the pivoting motions of the manipulator hand. The present invention also allows for a maximum possible welding velocity that can be maintained at the component, which advantageously allows for more weld seams to be produced than compared with conventional techniques. The prior art as a whole fails to disclose such features or such precision and manufacturing cost saving advantages.

Bannister fails to teach and fails to suggest the combination of adjusting one or more of laser power and velocity of welding based on an angle at which a laser beam is delivered to a component. Bannister merely discloses a multiaxial manipulator that carries a multiaxial robot hand, on which a laser tool is arranged on the outer side at a driven flange. According to Column 2, lines 37-40 of Bannister, the shoulder and arm members of the robot are moved to move the focal point and to follow the welding path. However, Bannister does not provide any teaching or suggestion for changing laser power or velocity of the welding or both as a function of the angle at which the laser beam is delivered. In fact, Bannister fails to disclose that a fiber optic cable connects a laser source to a laser head as claimed. The fact that a fiber optic cable is used to connect the laser source to the laser head is significant in the present invention

because it advantageously allows the manipulator hand to move with rapid and short rotary motions. Compared to the present invention, Bannister does not disclose a fiber optic cable as claimed, but instead directs the person of ordinary skill in the art toward a complicated articulated tube arrangement to deliver a laser beam from a laser source. As such, the prior art as a whole fails to establish a *prima facie* case of obviousness as the cited prior art reference does not teach or suggest important features of the claimed combination.

Mangiarino et al. also fails to teach or suggest the combination of varying at least one of laser power and velocity of welding based on an angle at which a laser beam is delivered to a component. Mangiarino et al. discloses a laser beam that is passed on the inside through a robot wherein the orientation of the laser beam is changed at the exit by a pivotable mirror 4. However, there is no teaching and no suggestion in Mangiarino et al. for changing the laser power or the velocity of the laser beam based on an angle at which the laser beam is delivered by the mirror 4. In fact, the references as a whole provide no suggestion for using the teachings of Mangiarino et al. to modify the device of Bannister. At most, Mangiarino et al. discloses a pivotable mirror 4 that changes the direction of the laser beam, but Mangiarino et al. is completely void of any mention of changing laser output or velocity based on an angle of the laser beam. As such, the prior art as a whole takes a different approach and fails to direct the person of ordinary skill in the art toward important aspects of the claimed combination.

Faitel fails to teach and fails to suggest the combination of varying one or more of laser output and velocity of welding based on an angle at which a laser beam is delivered. Faitel merely discloses a laser manipulator 14' that moves in a translatory manner and rotates a lens

array. According to Faitel, a laser beam is sent through flexible cable from an external laser beam source and work pieces are moved on a conveyor belt and a pallet so that the work pieces can be welded. The references as a whole fail to provide any suggestion of using the teachings of Faitel to modify the device of Bannister. Faitel does not provide any teaching that the laser manipulator 14 can be used in combination with a multiaxial manipulator or that the laser manipulator can be moved by rotary motions of a robot hand about at least one of its axes in order to guide a laser beam along a path. In fact, Faitel fails to disclose that the velocity and/or the laser output is changed as a function of the angle at which the laser is sent to the work pieces. Compared with Faitel, at least one of the velocity and the laser output is changed based on an angle at which the laser beam of the present invention is delivered to the component. This advantageously provides for precise control of the laser beam and for a more accurate weld. Faitel fails to disclose such precision and accurate control advantages since Faitel does not teach or suggest controlling velocity and/or laser power based on an angle of a laser beam. As such, the prior art as a whole fails to establish a *prima facie* case of obviousness since the prior art as a whole does not disclose important features of the claimed combination. Accordingly, Applicant respectfully requests that the Examiner favorably consider claims 1 and 15 as now presented and all claims that respectively depend thereon.

Claims 2, 16, 17 and 20 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Bannister in view of Mangiarino et al. and Faitel, and further in view of Hario et al. (JP 1-97,092). Although Hario et al. discloses laser beam welding equipment, the references as a whole fail to suggest the combination of features claimed. Specifically, the

references as a whole fail to provide any suggestion for the combination of varying one or more of laser power and velocity of welding based on an irradiation angle of the laser beam. As such, the references do not suggest the invention and therefore all claims define over the prior art as a whole.

Claims 4 and 18 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Bannister in view of Mangiarino et al. and Faitel, and further in view of Ishida et al. (JP 63-108,979). As previously discussed above, Bannister, Mangiarino et al. and Faitel do not teach or suggest the combination of adjusting at least one of laser power and velocity of welding based on a laser beam irradiation angle. Ishida et al. also fails to disclose such a feature. Ishida et al. merely discloses using a high-energy beam to weld two parts together. However, Ishida et al. is void of any mention of varying the high-energy beam based on an angle of the high-energy beam as claimed. As such, the prior art as a whole fails to direct the person of ordinary skill in the art toward each feature of the present invention. Accordingly, all claims define over the prior art as a whole.

Claims 12 and 13 have been rejected under 35 U.S.C. 103(a) as being unpatentable over Bannister in view of Mangiarino et al. and Faitel, and further in view of Hamada et al. (WO 2004020140 A1).

Claims 12 and 13 have been canceled. However, it is Applicant's position that Hamada et al. is not a proper prior art reference as it has a 102(e) date of March 11, 2004, which is not prior to Applicant's claimed foreign priority date of September 24, 2003. Applicant has attached a translation of the present application. Accordingly, Applicant respectfully requests

that the reference be removed as it is not prior art.

Claim 14 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Bannister in view of Mangiarino et al. and Faitel, and further in view of Takahashi (JP 10-58,179). Although Takahashi discloses using a zoom lens to adjust the focus of a laser beam, the references as a whole fail to suggest the combination of features claimed. Specifically, the references as a whole fail to provide any suggestion for the combination of varying one or more of laser power and velocity of welding based on an irradiation angle of the laser beam. As such, the references do not suggest the invention and therefore all claims define over the prior art as a whole.

Applicant has added new claims 21-24. New independent claim 21 provides for a device for laser beam welding of vehicle bodies, which provides for similar features as those found in claim 1. New dependent claims 22-24 are based on new independent 21 and have been added to further clarify the features of the invention. Applicant respectfully requests that the Examiner favorably consider new claims 21-24.

Favorable consideration on the merits is requested.

Respectfully submitted  
for Applicant,



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Attached: Translation of application  
Petition for One Month Extension of Time

JJM:BMD  
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